REMARKS

The present response is intended to be fully responsive to all points of objection and/or rejection raised by the Examiner and is believed to place the application in condition for allowance. Favorable reconsideration and allowance of the application is respectfully requested.

Applicants assert that the present invention is new, non-obvious and useful. Prompt consideration and allowance of the claims is respectfully requested.

Status of Claims

Claims 1-38 are pending in the application.

Claims 25 and 28 have been objected to.

Claims 1-38 have been rejected.

Claims 1, 8, 10, 17, 19, 25 and 28 have been voluntarily amended for clarification. No narrowing of the claims is intended.

Claim Objections

In the Office Action, the Examiner objected to claims 25 and 28 because of alleged informalities. The Examiner has objected that "[t]he phrase 'the first and second complementary images are substantially non-overlapping' recited in claims 25 and 28 is confusing since it is not clear at where are these two images not overlapping."

First, with respect to Examiner's inquiry, if the first and second images "are generated along the same optical axis . . . shouldn't they be overlapped?" Applicants point out that the first and second images are produced along a common optical axis by the image source; however, they are not necessarily projected onto the same area of the surface of the reflecting unit. This is one of the purposes of the redirecting unit coupled to the image source, that is, "to direct at least said first and second images to at least first and second, respective, spatial

regions of said reflecting unit." Accordingly, whereas the first and second images may be produced along the same optical axis, the axis may be altered by the redirecting unit, and the first and second images may be projected onto different spatial regions of the reflecting unit based on the different property.

In any event, in order to clarify the scope of the claims, Applicants have amended claims 25 and 28. In addition, Applicants have amended claims 1, 10 and 19 for clarification to reflect that the first and second regions of the reflecting unit are different areas, not the same area. These amendments do not narrow the scope of the claims, but rather, are intended to clarify the intent of claims.

In light of the above explanation and clarifying amendments, Applicants respectfully assert that the claims are proper under 35 USC 112 and request that the objection be withdrawn.

CLAIM REJECTIONS

35 U.S.C. § 112 Rejections

In the Office Action, the Examiner rejected claims 1-7, 9-16 and 18-38 under 35 U.S.C. § 112, first paragraph as failing to comply with the enablement requirement on several grounds. It will be noted that the third, fourth and fifth grounds of the rejection, as treated below were raised in the previous Office action mailed March 16, 2004, and fully responded to in Applicants' response of August 16, 2004. Applicants are unsure in what regard the Examiner requires clarification, but will be glad to provide such clarification should the Examiner so desire.

First, the Examiner stated that the specification and the claims fail to teach a reflecting unit being a diffractive optics or hologram, as recited in claims 2-4, 11-13 and 20-23, when the property is polarization. Applicants point to page 8 lines 10-21 of the specification, which states:

> Fig. 5 depicts a visor 15 having diffractive optics 94 and 96 formed therein. Since the visor 15 is the last optical element before the eye, improving this element (the visor) improves the over-all system performance. Additionally, by adding the diffractive optics to the visor, it is possible to remove some of the optics from within relay optics 10, creating a lighter unit. . . . Techniques to produce diffractive lens from/on the visor may be: etching, diamond turning, lithography, molding.

Furthermore, page 9 lines 1-5 state:

> Using the same optical relay 10 to achieve a non-distorted wide-FOV imagery, the field correction can be done by reverse-image correction manipulation on the image source such that the projected image to the eye will be non-distorted. Or the correction can be done on the reflected element 15 (visor/combiner) by using a powered reflected optical element such as diffractive, hologram, binary optics.

Accordingly, the specification teaches using a reflecting unit, e.g., diffractive optics or hologram, to improve performance and/or efficiency in conjunction with the present invention. This reflecting unit may be used with either the wavelength embodiment or the polarization embodiment to reflect the projected images to the eye of the user. Methods for optimizing the reflecting unit based on wavelength or polarization are known in the art. Accordingly, Applicants respectfully assert that the specification is enabling and the rejection is traversed.

Second, the Examiner has stated that the specification and claims fail to teach that a redirecting unit can direct the images to the spatial regions of a reflecting unit based on the different optical property of the first and second complementary images wherein the property is either wavelength or polarization. Applicants respectfully disagree with the Examiner's objection. An image source produces first and second complementary images differing in at least one optical property, and the redirecting unit directs the first and second images first and second spatial regions of a reflecting unit based on the optical property. Apparently, the Examiner agrees that a redirecting unit is disclosed for the wavelength property and that the redirecting unit is disclosed for the polarization property. The claim does not require that the same redirecting unit be suitable for both wavelength and polarization redirecting, although a redirecting unit may combine the features of both a wavelength and a polarization redirector. Accordingly, the Examiner's rejection is respectfully traversed.

Third, the Examiner inquired how a redirecting unit can be a polarization selective reflective device capable of directing said first and second images to first and second respective spatial regions of a reflecting unit.

The rejection is respectfully traversed, insofar as such devices are (and were at the time of filing of the present application) well known to those of ordinary skill in the art. First, Applicants respectfully direct the Examiner's attention to page 7 of the specification, where it is stated that in one embodiment of the invention, "image redirector 40 . . . is embodied by an optical device 92 (such [as] a wedge with two polarization-dependent reflective planes)." Such a wedge having two polarization-dependent reflective planes, each for reflecting light of a different polarization, would operate to direct light polarized differently in different directions.

The practical and theoretical bases for such an element described in the embodiment are well known in the art. For example, attached to Applicants' previous response to Office action (filed August 16, 2004), as Appendix A are pages 331-335 of a 1965 Edition of Applied Optics and Optical Engineering, by Rudolf Kingslake. In these pages, polarization by double refraction is described, for example by use of a Rochon or Wollaston prism.

Other devices are known in the art for such purposes and commercially available. For example, Applicants have attached to the previous response to Office action (filed August 16, 2004) as Appendix B, pages 234-235 of a 1998-99 catalog for laser and photonics applications from Coherent, which offer for sale polarizing beamsplitting cubes and prisms. As explained therein, the effect of such devices is to receive an incoming beam and divide it into its component polarized components. Any of these devices would take a beam of a first polarization and direct it in a first direction and direct a second beam of a second polarization in a second direction.

Fourth, the Examiner inquired how an image source can be capable of generating spatially complementary images of different wavelengths or of different polarizations.

In response, Applicants respectfully direct the Examiner to page 7 of the specification, where Applicants state that in one embodiment of the invention, image source may be "one common display (such as with a LCD display). The image source may be any type of display technology using P&S polarizers or LCD technology (such as from: Sony, Sharp, Kopin, MicroDisplay and others). . ." It is well known that a liquid crystal display (LCD) polarizes an incoming light beam by 90°. Accordingly, allowing a polarized image to pass the LCD without electro-optic modulation would produce an image having a first polarization. Alternatively, taking the polarized image and electro-optically modulating it would produce an image having a second polarization orthogonal to the first.

With respect to the Examiner's inquiry regarding producing images having different wavelength, it is also known that an LCD may produce multiple colors (such as in today's laptop computers). Accordingly, in one embodiment of the invention, by using the same LCD image source to produce different colored images in time sequence, different wavelength images may be formed.

Fifth, and finally, the Examiner inquired how the wavelength sensitive redirecting unit can be capable of directing first and second complementary images to different spatial locations according to wavelength.

This element, too, is well known in the art. The Examiner is respectfully reminded that a prism does precisely this – direct beams of light having different wavelengths to different places. Hence, when white light enters a prism, the component colors (wavelengths) emerge at different angles, i.e., to different spatial locations.

Applicants respectfully assert that the claims are proper under 35 USC 112 and request that the rejections be withdrawn.

35 U.S.C. § 103 Rejections

In the Office Action, the Examiner rejected claims 1-7, 9-16, 18-23, 35 and 37 under 35 U.S.C. § 103(a), as being unpatentable over the patent issued to Preston (US Patent No. 6,094,283).

Preston discloses "A holographic display system comprising left and right optical systems . . . The optical systems each comprise an image display operable to display an input image and first and second holographic devices." (Abstract).

In the device according to the Preston reference, each of the image display units takes a single image and decomposes it into its RGB components and transmits each of these separately to the same area of the eye piece 38, thereby recreating the single image. Thus, each of the left and right input image displays 40 projects only one image on its respective portion of the reflective eye piece 38. That is, the left input image display projects a first image on the left side of the eye piece 38 to be viewed by the left eye, and the right input image display projects a second image on the right side of the eye piece 38 to be viewed by the right eye. This is clearly seen in the series of figures including Figs. 2A and 2B. Finally, these two images, produced by two different input image displays on separate portions of the eye piece to be viewed by different eyes do not physically overlap on the eye piece.

Applicants respectfully assert that Preston does not render obvious the pending claims because it does not disclose or suggest every element of the pending claims.

First, the Examiner states that in each side of the eye piece, the color components of each image are "first and second complementary images differing in wavelength." These, however, are not first and second complementary images, as recited in claims 1 and 10, but rather first and second color components of the same image.

Moreover, because each input image display 40 displays a single image in its color components, and not two different images (as recited in claims 1 and 10), this same single image of Preston is reconstructed at the same area of the eye piece 38 (see Fig. 1). Preston therefore does not teach directing "first and second images to at least first and second, respective, spatial regions of a reflecting unit based on said different optical property."

Preston teaches directing the first and second color components of the same image to the same area of the eye piece, thereby producing a single image at one location.

Finally, as an aside, Applicants respectfully disagree with the Examiner's assertion regarding the field of view in the Preston reference. While it may be true that the overall image seen by the viewer is wider than that of each of the relay optics, this widening is not performed by one relay optic, but by the combination of two relay optics.

Therefore, the Preston reference does not render obvious claims 1 and 10 because it does not teach or suggest either (a) an image source to produce along a common optical axis at least first and second complementary images nor (b) a redirecting unit coupled to said image source to direct at least said first and second images to at least first and second, respective, spatial regions of a reflecting unit.

Likewise, with respect to claim 19, the method of operation of the Preston reference does not teach or suggest "producing along a common optical axis at least first and second complementary images" nor "directing at least said first and second images to at least first and second, respective, spatial regions of a reflecting unit."

In any event, Applicants have amended claims 1, 10 and 19 for clarification to reflect that the first and second regions of the reflecting unit are different areas, not the same area. This amendment does not narrow the scope of the claims, but rather, is intended to clarify the intent of first and second regions of the reflecting unit.

Based on the above, pending independent claims 1, 10 and 19 of the Application are not rendered obvious in light of the Preston reference, either alone or in combination with any other art of record. Therefore, claims 2-7, 9, 11-16, 18, 20-23, 35 and 37, which depend from the above independent claims are likewise not obvious in view of the art of record.

Applicants respectfully assert that the above claims are allowable over the art of record and request that they be promptly allowed.

In the Office Action, the Examiner rejected claims 34, 36 and 38 under 35 U.S.C. § 103(a), as being unpatentable over the patent issued to Preston as applied to claims 1, 10 and 19 above, and further in view of the patent issued to Chauvin (US Patent No. 5,198,928).

In the Chauvin reference, "[a] binocular, stereoscopic helmet visor display is described, wherein a polarization x-prism is used to separate the left eye imagery from the right eye imagery when each channel has a unique polarization. Separate image sources generate the left and right eye imagery, and the respective left and right image light is passed through polarizers so that the respective left and right image light is of opposite polarizations." (Abstract, emphasis added).

As discussed with respect to Preston, above, Chauvin does not teach or suggest (a) an image source to produce along a common optical axis at least first and second complementary images or (b) a redirecting unit coupled to said image source to direct at least said first and second images to at least first and second, respective, spatial regions of a reflecting unit, as recited in claims 1, 10 and 19, from which claims 34, 36 and 38 respectively depend indirectly.

Therefore, the claims are not rendered obvious in light of Preston in light of Chauvin, and Applicants respectfully allow their allowance.

In the Office Action, the Examiner rejected claims 8 and 17 under 35 U.S.C. § 103(a), as being unpatentable over USPN 5,652,666 (Florence et al.).

The Examiner claimed that Florence contains all the limitations of the claims with the exception that it does not teach use of a reflecting unit as the means for forming the integrated image, and that using a reflecting unit as the means for forming the integrated image as claimed would have been obvious to one skilled in the art.

Applicants respectfully traverse the rejection of claims 1 and 10 based on Florence because a prima facie case of obviousness has not been established. Florence does not disclose all of the elements of claims 1 and 10 of the present Application except for a reflecting unit as the means for forming the integrated image.

Florence discloses "[a] method of using a display system having a spatial light modulator (14) to display holographic images. The spatial light modulator (14) generates images that represent vertical strips of a hologram. These images are de-magnified by a three-dimensional optics unit (18), in the horizontal direction so as to form image strips. A scanning mirror (45) scans the image strips in a series across an image plane at a rate sufficiently fast that the viewer perceives a composite hologram comprised of these image strips." (Abstract).

In particular, Florence describes a digital micro-mirror device (DMD) 14 (or other spatial light modulator (SLM)) to produce a single image. This entire single image is then relayed continuously vertical strip by vertical strip using relay optics 41-43 and a scanning mirror 45, and then to an image plane 46. (See col. 5 lines 3-13, Fig. 4). Thus, in Florence an entire image is produced by an image source, but only portions of it are viewed at the image plane in a scanning action.

Florence does not render obvious claims 8 or 17 because it does not disclose "an image source to produce along a common optical axis at least first and second complementary images." To the extent that the vertical strips of Florence may be called first and second complementary images, these are not produced along a common optical axis, but rather, along adjacent but separate optical axes. Nor would producing the different vertical strips along a common optical axis have been obvious in light of Florence.

Therefore, claims 8 and 17 are allowable over Florence and should promptly be allowed.

In view of the foregoing remarks, the pending claims are deemed to be allowable. Their favorable reconsideration and allowance is respectfully requested.

Should the Examiner have any question or comment as to the form, content or entry of this Amendment, the Examiner is requested to contact the undersigned at the telephone number below. Similarly, if there are any further issues yet to be resolved to advance the prosecution of this application to issue, the Examiner is requested to telephone the undersigned counsel.

Please charge any fees associated with this paper to deposit account No. 05-0649.

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